

CLAIMS

1. (Previously Presented) A method for implementing protection switching for a virtual private network comprising the steps of
 - establishing a working virtual private network path and a protection virtual private network path between a first edge node and a second edge node; and
 - switching traffic from the working virtual private network path to the protection virtual private network path when detected traffic congestion in the working virtual private network path exceeds a predetermined threshold.
2. (Original) The method of claim 1 further comprising:
 - detecting failure of the working virtual private network path; and
 - switching traffic from the working virtual private network path to the protection virtual private network path when failure of the working virtual private network path is detected.
3. (Original) The method of claim 1 further comprising:
 - detecting a return to proper functioning of the working virtual private network path; and
 - switching traffic from the protection virtual private network path to the working virtual private network path when said return to proper functioning of the working virtual private network path is detected.
4. (Original) The method of claim 1 further comprising:
 - establishing a management channel in at least one of said working virtual private network paths;
 - connecting said management channel between said first edge node and said second edge node;
 - transmitting time stamps across said management channel;

transmitting network measurement parameters across said management channel; and

analyzing said time stamps and said network management parameters to detect failures or congestion in said working virtual private network path.

5. (Previously Presented) The method of claim 4, wherein said time stamps and said network management parameters are analyzed by an algorithm in said first edge node.

6. (Previously Presented) The method of claim 4, wherein said time stamps and said network management parameters are analyzed by an algorithm in said second edge node.

7. (Previously Presented) The method of claim 4, wherein said working virtual private network path has an overall capacity and said management channel has a utilization not exceeding approximately ten percent of said overall capacity.

8. (Previously Presented) The method of claim 1 further comprising: sending time stamps across said working virtual private network path and said protection virtual private network path.

9. (Previously Presented) The method of claim 8 further comprising: utilizing said time stamps for synchronizing data transmission across said working virtual private network path and said protection virtual private network path.

10. (Original) The method of claim 8 further comprising: utilizing said time stamps to enable recovery of data lost on said working virtual private network path and said protection virtual private network path.

11. (Original) The method of claim 1 further comprising:

establishing quality of service parameters for said working virtual private network path and said protection virtual private network path;

assigning the quality of service parameters to said working virtual private network path and said protection virtual private network path; and

synchronizing said first edge node and said second edge node according to the quality of service parameters.

12. (Previously Presented) An apparatus for protection switching of a virtual private network comprising:

a working virtual private network path connected between a first edge node and a second edge node;

a protection virtual private network path connected between the first edge node and the second edge node;

a congestion detector; and

a data switch,

wherein when data is transmitted across the working virtual private network path, said congestion detector is configured to detect traffic congestion on said working virtual private network path and said data switch switches said data from said working virtual private network path to said protection virtual private network path when said traffic congestion exceeds a predetermined threshold.

13. (Original) The apparatus of claim 12 further comprising a failure detector, wherein said failure detector detects failure of said working virtual private network path and said data switch switches said data from said working virtual private network path to said protection virtual private network path when said failure is detected by said failure detector.

14. (Previously Presented) The apparatus of claim 12 further comprising:

a normal operation detector; and

a second data switch,

wherein when said normal operation detector detects a return to normal functioning of said working virtual private network path, said second data switch switches said data from said protection virtual private network path to said working virtual private network path.

15. (Previously Presented) The apparatus of claim 12 further comprising:

a management channel in at least one of said working virtual private network paths;

a plurality of time stamps transmitted across said management channel; and

a plurality of network measurement parameters transmitted across said management channel;

wherein said time stamps and said network management parameters are analyzed to detect a failure or congestion in said working virtual private network path.

16. (Original) The apparatus of claim 15, wherein said time stamps and said network management parameters are analyzed by an algorithm in said first edge node.

17. (Original) The apparatus of claim 15, wherein said time stamps and said network management parameters are analyzed by an algorithm in said second edge node.

18. (Previously Presented) The apparatus of claim 15 wherein said working virtual private network path has an overall capacity, and wherein the apparatus is configured to limit utilization of said management channel to an amount not exceeding approximately ten percent of said overall capacity.

19. (Previously Presented) The apparatus of claim 12 further comprising a plurality of time stamps sent across said working virtual private network path and said protection virtual private network path.

20. (Previously Presented) The apparatus of claim 19, wherein said plurality of time stamps are configured to synchronize data transmitted across said working virtual private network path and said protection virtual private network path.

21. (Original) The apparatus of claim 19, wherein said plurality of time stamps enable recovery of data lost from said working virtual private network path and said protection virtual private network path.

22. (Previously Presented) The apparatus of claim 12 further comprising a plurality of quality of service parameters assigned to said working virtual private network path and said protection virtual private network path.

23. (Previously Presented) The apparatus of claim 22, wherein said first edge node and said second edge node are synchronized according to said plurality of quality of service parameters.

24. (Previously Presented) An apparatus to implement switching between a working virtual private network path and a protection virtual private network path between in a virtual private network, comprising:

a monitor module configured to monitor the working virtual private network path to monitor traffic flow thereon, the monitor module configured to cause a switch in traffic from the working virtual private network path to the protection virtual private network path in response to a detected event selected from a group of events comprising congestion in the working virtual private network path that exceeds a predetermined threshold and link failure in the working virtual private network path.

25. (Previously Presented) The apparatus of claim 24 wherein the monitor module is configured to continue to monitor the working virtual private network path, the monitor module configured to cause a switch in traffic from the protection virtual private network path to the working virtual private network path if the event selected from the group of events is congestion in the working virtual private network path and traffic flow in the working virtual private network path no longer exceeds the predetermined threshold.

26. (Previously Presented) The apparatus of claim 24 wherein the monitor module is configured to continue to monitor the working virtual private network path, the monitor module configured operating to cause a switch in traffic from the protection virtual private network path to the working virtual private network path if the event selected from the group of events is link failure in the working virtual private network path and the monitor module determines that there is no longer a link failure in the working virtual private network path.

27. (Previously Presented) The apparatus of claim 24 wherein the working virtual private network path and the protection virtual private network path are established between first and second router/switches, the monitor module being integrated into one of the first and second router/switches.

28. (Previously Presented) The apparatus of claim 24 wherein the working virtual private network path and the protection virtual private network path are established between first and second router/switches, the monitor module operative independently from the first and second router/switches.

29. (Previously Presented) A virtual private network, comprising:
a router/switch configured for communication over a communication network, the router/switch being configured to establish a working virtual private network path and a protection virtual private network path over the communication network; and

a monitor module configured to monitor the working virtual private network path to monitor traffic flow thereon, the monitor module configured to cause the router/switch to switch traffic from the working virtual private network path to the protection virtual private network path in response to a detected event selected from a group of events comprising congestion in the working virtual private network path that exceeds a predetermined threshold and link failure in the working virtual private network path.

30. (Previously Presented) The apparatus of claim 29 wherein the monitor module is configured to continue to monitor the working virtual private network path, the monitor module configured to cause the router/switch to switch traffic from the protection virtual private network path to the working virtual private network path if the event that caused the router/switch to switch traffic from the working virtual private network path to the protection virtual private network path is no longer present.

31. (Previously Presented) The apparatus of claim 29 wherein the monitor module is integrated into the router/switch.

32. (Previously Presented) The apparatus of claim 29 wherein the monitor module is configured to operate independently from the router/switch.